CONNECTICUT RIVER BASIN ANADROMOUS FISHERIES RESTORATION:
Coordination and Technical Assistance
F-100-R-27

Federal Aid Progress Report
October 1, 2009 - September 30, 2010

U.S. Fish and Wildlife Service
Connecticut River Coordinator's Office
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Executive Summary

Federal Aid Project #F-100-R-27

States: Connecticut, Massachusetts, New Hampshire & Vermont

Project Title: Connecticut River Basin Anadromous Fisheries Restoration: Coordination and Technical Assistance

Period Covered: October 1, 2009 - September 30, 2010

Objectives:

- Coordinate the Connecticut River Anadromous Fish Restoration Program as a unified effort of State and Federal fishery agencies
- Provide technical assistance to the fishery agencies and other program cooperators
- Identify fishery program priorities, design and implement field projects to address issues and opportunities
- Administer several different federal grant programs to address fish habitat, fish passage, and research projects

Accomplishments:

Program Coordination:

- Coordinated three Connecticut River Atlantic Salmon Commission (CRASC) and two CRASC Technical Committee meetings
- Organized two lower river basin anadromous fish resources meetings and a CRASC Shad Studies Subcommittee meeting
- Organized the Atlantic Salmon Egg Rearing Program Teacher's Workshop
- Assisted in compilation of U. S. Atlantic Salmon Assessment Committee Report
- Coordinated American shad transfers from Holyoke Fish Lift, MA
- Coordinated with UMASS/Amherst Department of Natural Resources professors and students to develop student volunteer force for many office field activities

Technical Assistance:

- Provided program information to cooperators, researchers, and the public
- Assisted in transport and stocking Atlantic salmon fry in three basin states
- Conducted spring fish population assessments targeting river herring downstream of Holyoke Dam and in lower Farmington River
- Conducted spring pre-spawn blueback herring netting, trapping and transfer from

Wethersfield Cove, CT into three targeted waters in the basin
- Transferred pre-spawn American shad from the Holyoke Dam fishlift (MA) to the mainstem Connecticut River upstream of the Vernon Dam (VT)
- Mounted adult sea-run Atlantic salmon scales for age and growth analysis and completed aging and data analyses
- Maintained adult Atlantic salmon return and stocking databases
- Continued mainstem river American eel population assessment (MA)
- Conducted sea lamprey nest surveys in lower portions of tributaries (MA)
- Conducted weekly juvenile shad and herring seine surveys (upstream of Holyoke, MA) from July through October
- Downloaded basin wide temperature loggers, 26 units, (Old Lyme, CT to Moore Reservoir, NH) and redeployed them
- Data from all fish population survey work and transfers were entered in databases or spreadsheets
- Participated on Vermont Yankee Nuclear Power Station's Environmental Advisory Committee
- Participated in meetings of the CRASC Technical Committee's Salmon Studies, Shad Studies (lead), Fish Passage, Fish Culture, and Smolt Studies
- Developed grant agreements for habitat restoration project in NH (Warren Brook-Cold River) and others outside of the basin.
- Assisted in spawning of sea-runs, domestics, and kelts at state and federal facilities

Summary of Program Results:

- 51 adult Atlantic salmon were counted back to the Connecticut River basin (2010)
- A total of 10.86 million Atlantic salmon eggs produced (fall 2009)
- A total of 6.01 million Atlantic salmon fry released with volunteer help (spring 2010)
- A total of 43,696 Atlantic salmon smolts (viable) stocked, smolt assessment project continues with noted improvements in fish quality from hatchery actions, additional 19,036 age-2 parr and 6,255age-1 parr, also stocked.
- 168,794 adult American shad counted at basin fishways
- 1,545 pre-spawn American shad transferred and stocked upstream of Vernon Dam (VT)
- 92 adult blueback herring were counted at basin fishways
- A total of 7,975 blueback herring (pre-spawn) were netted and released into vacant/accessible habitat as a new restoration strategy
- A cooperative effort to analyze genetically marked fish families (archived and future smolt samples, adult returns, and hatchery parentage) was developed using VTDFW State Wildlife Grant funds, USFWS funding for genetic staffing, and NOAA purchasing of chemicals. This is a multi-year project to run through 2015 (last year of marked adult return expected, last marked fry plant is 2011).

- An estimated 245,000 smolts (+/- 95% of 135,000) were passed at Holyoke Dam based on the Cabot Station and Holyoke Dam mark/recapture study

Cost: **States:** $18,864 **Federal:** $346,229*

*this cost includes grant agreement awards for the nine grants administered by the Coordinator's Office (Inter-governmental, National Fish Passage Program, Eastern Brook Trout Joint Venture, and Atlantic Coastal Fish Habitat Partnership) that are noted in the attached narrative.

Acknowledgements

I would like to thank the many people who have contributed to the accomplishments that are contained in this annual report, most importantly my Office Assistant, Darleen Cutting who is invaluable to me and my Student Conservation Association Intern, Rueben Smit, who did a great job during his tenure. Another important recognition goes to Jeffrey Mosher (USFWS Berkshire National Fish Hatchery) who assisted us in field activities on a near weekly basis from April through October and also managed his duties in his new position at that hatchery.

Other people deserving of my appreciation for assisting in the accomplishments over this period:

USFWS -

- John (Bill) Fletcher, Darrell Weldon, David Sagan, and the staffs at Richard Cronin National Salmon Station, White River National Fish Hatchery, Dwight D. Eisenhower National Fish Hatchery, North Attleboro National Fish Hatchery and Berkshire National Fish Hatchery and the Northeast Fishery Center and its Lamar Fish Health Unit, Genetics Unit, and Population Dynamics staff.

States -

- Connecticut: Steve Gephard, Jacque Benway, Tim Wildman, Dave Ellis, Bruce Williams and their staff of seasonals
- Massachusetts: Caleb Slater, Dan Marchant and their staff
- New Hampshire: Matt Carpenter, Gabe Gries, and Jason Carrier
- Vermont: Jay McMenemy and Ken Cox

University of Massachusetts –

- Martha Mather and Bob Muth worked to develop a program with the Department of Natural Resources students that resulted in dozens of students assisting in field activities from April through the summer, providing over 350 hours of volunteer time.

LIST OF FIGURES

LIST OF APPENDICES

The Anadromous Fish Program and The Connecticut River Atlantic Salmon Commission

The administration of the interjurisdictional cooperative effort to restore Atlantic salmon and other anadromous fish species, including American shad, to the Connecticut River basin is accomplished through the Connecticut River Atlantic Salmon Commission (the Commission). The importance of this formally-structured, coordinating and regulatory body to the restoration program was recognized in 1983 when Congressional consent was given to the Connecticut River Basin Atlantic Salmon Compact, Public Law 98-138. The enabling legislation was re-authorized for another 20 years in 2002. This law (posted on the Connecticut River Coordinator's Office website), originally passed by the legislative bodies in each of the four basin states, created the Commission and conveys Congressional support to an interstate compact for the restoration of Atlantic salmon to the Connecticut River Basin. The Commission is comprised of ten Commissioners (Table 1) including a high-level government employee and a public sector representative appointed by the governor of the appropriate state, and the Northeast Regional Directors of both the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS).

The Commissioners act on policy matters and are advised on scientific and technical matters by a Technical Committee. The Technical Committee is comprised of senior staff biologists from each Commission member agency, the U.S. Forest Service (USFS), and the Massachusetts Division of Marine Fisheries (Table 2). To effectively address numerous technical issues related to the restoration program, the Technical Committee created several standing sub-committees with specific areas of responsibility (Salmon Studies, American Shad Studies, Fish Passage, Fish Culture, Smolt Studies, and Genetics Sub-committees). Other experts and cooperators from the member agencies, the U.S. Army Corps of Engineers, U.S. Geological Survey - Biological Resources Division (USGS), University of Massachusetts Cooperative Fish and Wildlife Research Unit, private industry, and conservation groups cooperate with the sub-committees and Technical Committee as needed and are invited to participate in meetings. The Connecticut River Coordinator (Coordinator), an employee of the USFWS, acts as the Executive Assistant to the Commission and the Secretary for the Technical Committee. The Coordinator also serves as a member on all the Technical Committee's Subcommittees, the Vermont Yankee Nuclear Power Station's Environmental Advisory Committee and the U.S. Atlantic Salmon Assessment Committee.

The Coordinator is responsible for coordination of state and federal activities, advocacy and outreach, and promotion of the multi-agency cooperative diadromous fish restoration program in the Connecticut River watershed (Figure 1). The Coordinator organizes necessary meetings, provides program assessment and planning documents, and maintains contact with interested parties. In addition, the Coordinator will identify management, assessment, and restoration needs or opportunities and develop and implement activities to achieve objectives. The Coordinator also provides technical assistance primarily by managing program data in a central program data base. Information is distributed to all the cooperators, the news media, and the public.

In addition to salmon restoration, other species are under rehabilitation in the Connecticut River basin, including American shad, blueback herring, sea lamprey, American eel, and alewife, primarily addressed by efforts to provide passage to historic habitats and provide safe downstream passage. During the period from 1967-1984 (prior to the Commission), restoration of anadromous fish (e.g. salmonids and clupeids, primarily Atlantic salmon, *Salmo salar*, and American shad, *Alosa sapidissima*) on the Connecticut River was guided by the Policy Committee and the Technical Committee for Fisheries Management of the Connecticut River Basin with structures and memberships that have been carried over to the Commission. These earlier committees remain in place today, and serve to address diadromous fish restoration issues not specified in the Commission's enabling legislation. These committees act in concert with the Commission and its supporting Technical Committee to address both salmonid and clupeid restoration. Because salmon and shad restoration share many common issues, the Shad Studies Sub-committee was established under the Commission to ensure full consideration of this important fishery resource and has also included river herring, principally blueback herring.

The Commission meets at least twice each year and the Technical Committee meets more frequently as needed. This report period, the Commission met on December 7, 2009; January 22, 2010; and June 22, 2010. The Technical Committee met on December 15, 2009 and June 17, 2010. Scheduled meetings are open to the public. Interested citizens are given the opportunity to provide input into the decision-making process. Area news publishers are notified of scheduled Commission meetings. Minutes of both Commission and Technical Committee meetings are produced and distributed by the Coordinator's Office. Approved Minutes were posted on the Connecticut River Coordinator's Office website. In addition to serving as an historic record, these minutes describe the progress and status of restoration efforts. Program reporting occurs in a number of other forums. The Atlantic salmon restoration results are reported to the U.S. Atlantic Salmon Assessment Committee which produces a summary document each year for all of New England.

During this reporting period, Mr. William Hyatt became Chief of the Connecticut Department of Environmental Protection (CTDEP) Bureau of Natural Resources and was replaced as Fisheries Division Chief by Mr. Peter Aarrestad. In June 2010, it was determined that the USFWS Technical Committee member, Mr. John (Bill) Fletcher would need to step down due to health issues. The Committee recognized the significant contributions Bill had made on many topics regarding fish culture, health and management and wished him well at their June meeting. The USFWS named Dr. William Ardren as the new Committee member. Dr. Ardren works out of the Lake Champlain Fish and Wildlife Conservation Office (VT). The Commission's Massachusetts Public Sector member remains vacant.

Table 1. Connecticut River Atlantic Salmon Commission Membership.

Connecticut River Atlantic Salmon Commission	
Federal	**U.S. Fish and Wildlife Service** *Marvin Moriarty* Regional Director, Region 5 *Jaime Geiger, alternate*
	National Marine Fisheries Service *Chris Mantzaris*
Connecticut	**Connecticut Dept. of Environmental Protection** *William Hyatt* Chief, Bureau of Natural Resources *Stephen Gephard, alternate*
	Public Sector Representative *Robert A. Jones*
Massachusetts	**Massachusetts Division of Fisheries and Wildlife** *Wayne F. MacCallum* Director *Mark Tisa, alternate*
	Public Sector Representative *vacant*
New Hampshire	**New Hampshire Fish and Game Department** *Glenn Normandeau* Executive Director *Scott Decker, alternate*
	Public Sector Representative *Richard C. Shelton*
Vermont	**Vermont Department of Fish and Wildlife** *Wayne Laroche* Commissioner Chair *Eric Palmer, alternate*
	Public Sector Representative *Peter H. Basta*

Table 2. Connecticut River Atlantic Salmon Commission Technical Committee Membership.

Connecticut River Atlantic Salmon Commission Technical Committee	
Federal	**U.S. Fish and Wildlife Service** *William Ardren*
	National Marine Fisheries Service *Vacant*
	U.S. Forest Service *Dan McKinley*
Connecticut	**Connecticut Dept. of Environmental Protection** *Stephen R. Gephard*
Massachusetts	**Massachusetts Division of Fisheries and Wildlife** *Caleb Slater* Chair
	Massachusetts Division of Marine Fisheries *Mike Armstrong*
New Hampshire	**New Hampshire Fish and Game Department** *Matthew Carpenter*
Vermont	**Vermont Department of Fish and Wildlife** *Jay McMenemy*

Coordination and Technical Assistance Funding

The Connecticut River Coordinator's Office, under Federal Aid Project No. F-100-R-27, received $20,000, to coordinate the program and provide technical assistance through the Federal Aid in Sport Fish Restoration Project. The project was assessed an administrative overhead fee leaving $18,864 available for the program. The USFWS utilized the Federal Aid funds, along with $346,229 including base funding and fish passage and habitat restoration funding (pass through grant agreements to partners, listed later) to ensure that planned objectives were accomplished. Operating expenses and salaries for the Coordinator's Office were covered by these funds in fiscal year 2010. [The Sunderland Fishery Resources Office has not been funded or staffed since October 17, 2004.]

Project Accomplishments

The Connecticut River Coordinator's Office enhanced the Commission's ability to manage the restoration program through a variety of activities and accomplishments:

Coordination

- The Coordinator's Office continued to provide administrative support to the Commission and Technical Committee as the Executive Assistant and Secretary, making all necessary meeting arrangements, setting agendas, handling mailings, monitoring financial receipts and dispersements, recording and distributing minutes of Commission and Technical Committee meetings. The Coordinator also participated on the Fish Passage, Smolt Studies, Salmon Studies, Genetics, Fish Culture, and Shad Studies Subcommittees. The Coordinator organized a Shad Studies meeting and also organized two meetings focused on fisheries needs in the lower river basin, targeting river herring population status and developing a more active restoration strategy.

- The Coordinator's Office continued to administer the four-state (Connecticut, Massachusetts, New Hampshire, Vermont) Federal Aid Project to provide for program coordination and technical assistance.

- The Coordinator's Office compiled information for use by the U.S. Atlantic Salmon Assessment Committee in its annual report for 2010 and attended the annual meeting in Portland, Maine.

- The Coordinator participated as a member on the Vermont Yankee Nuclear Power Station's Environmental Advisory Committee.

- The Coordinator worked with University of Massachusetts Amherst Department of Natural Resources Faculty and students to develop a volunteer program to provide critical field assistance for activities running from early April through mid October.

- The Coordinator worked with CTDEP, New Hampshire Fish and Game (NHFG), Rhode Island Division of Fish and Wildlife (RIDFW), USGS, and Holyoke Gas and Electric to develop a trap and transfer schedule for the Holyoke Fish Lift.

Fisheries Management, Evaluations and Technical Assistance:

- The Coordinator's Office developed a river herring population assessment project using boat electrofishing and pound net gear. Net gear was fished in Wethersfield Cove, CT from April 12 – May 5, 2010. The net gear was pulled when large schools of blueback were present in the cove, filling the net. Boat electrofishing was conducted once to two times per week from April 12 through June 7, primarily at night. Electrofishing transects were run from Rocky Hill, CT to Chicopee, MA and also included the lower Farmington River. All sites were geo-referenced and CPUE measures will be derived and compared. A total of 435 blueback herring and 94 alewife were processed for biological data as part of assessment work. A separate population assessment report is to be completed by spring of 2011. Scale reading for age and spawning history remains to be completed for both species subsamples.

- The Coordinator's Office developed a net and transfer project for pre-spawn blueback herring, initially expecting to use the pound net gear, which once inundated with herring in May was quickly removed. A shift to seining on the cove shoreline became the preferred approach and worked extremely well when fish were present (Table 3).

Table 3. Capture and transfer summary for blueback herring restoration in spring of 2010, out of Wethersfield Cove, Wethersfield, CT.

Date	Gear	Release site	Number alive
4/28	Pound net	Westfield River, Russell (MA)	70
5/4	Seine	Westfield River, Russell	750
5/5	Seine	Westfield River, Russell	800
5/6	Seine	Westfield River, Russell	1300
		Sub-total	**2,920**
5/17	Seine	Farmington River, Farmington (CT)	**4,575**
		(six tank trips w/CTDEP)	
5/24	Seine	Oxbow, CT River, Easthampton (MA)	**480**
		Grand total	**7,975**

- The Coordinator's Office continued a shad restoration program in cooperation with the NHFG, CTDEP, RIDFW and the USGS. A summary of American shad transfers from Holyoke Fish Lift and stocking locations are provided in Table 4.

Table 4. Summary of American shad transfers from Holyoke Fish Lift spring of 2010 with stocking locations.

Agency	Stocking location	Number transported	Number released alive
USFWS	CT River, Vernon Dam pool	1,191	1,151
CTDEP	CT River, Vernon Dam pool	240	234
RIDFW	CT River, Vernon Dam pool	100	100
USGS	CT River, Vernon Dam pool	60	60
	Totals	**1,591**	**1,545**

Agency	Stocking location	Number transported	Number released alive
NHFG	Ashuelot River (CT R)	160	141
CTDEP	Farmington River (CT R)	160	156
CTDEP	Naugatuck River	160	144
CTDEP	Quinnipiac River	163	163
RIDFW	North Attleboro NFH	82	80
USGS	Study fish	n/a	n/a
	Totals	**725**	**684**

The Coordinator's Office staff (Office Assistant and intern) lethally sampled 60 shad at the Holyoke Dam for a wild fish health assessment, in cooperation with the USFWS Northeast Fishery Center, Lamar Fish Health Center. All shad tested negative for pathogens of concern.

- Staff from the Coordinator's Office completed sea lamprey nest surveys (MA) in the lower Green River, Greenfield, downstream of the first dam. A total of 184 lamprey nests were documented in late June (up from 57 counted in 2009). Other counts included lower Sawmill River, Montague (80 nests), Lower Manhan River, East Hampton (20 nest), Lower Fall River, Gill (27 nests), Mill River, Hadley (23 nests), and Amethyst Brook, Pelham (40 nests). All start and end points were GPS referenced. Staff also assisted CTDEP in lamprey surveys in the Salmon River (CT).

- The Connecticut River Coordinator's Office assisted the Richard Cronin National Salmon Station (RCNSS) staff by providing sea-run processing data sheets and PIT tags, providing an Avid Power Tracker V PIT tag reader. Staff assisted RCNSS and White River NFH in 2009 spawning activities during the report period and also Roger Reed State Fish Hatchery. In the spring of 2010 data were gathered and entered in a

database on returning adults from trap/hatchery sheets.

- The Coordinator supervised one 5 month Student Conservation Association (SCA) intern and utilized many dozens of students from UMASS/Amherst. The total tally of student volunteer time is approximately 400 hours, along with USFWS personnel from other offices (~200 hours), and other adult volunteers (~150 hours) that were essential to achieving project/program objectives primarily in field activities.

- The Coordinator continued the American eel population assessment started in 2009 in late summer of 2010. Night boat electrofishing, back-pack electrofishing and baited eel pot gear were used in reaches from Chicopee, MA to Montague, MA on the mainstem. A separate progress report is targeted for spring 2011. All data have been entered. This work is scheduled to continue in 2011.

- The Coordinator's Office, with a loan of net gear from CTDEP, and use of an S.O. Conte Refuge john boat, identified 5 juvenile shad and herring sample sites upstream of Holyoke Dam. Weekly sampling was conducted using seine gear and techniques, duplicating CTDEP's approach for seven long-term sites downstream of Holyoke Dam. Sampling began mid-July and concluded in mid-October (due to required two week training in WV). A total of 2,103 juvenile shad and seven blueback herring were netted. Data have been entered and a report will be developed by spring 2011. Data will also be provided to CTDEP. The juvenile index sites are planned for continued sampling in 2011 and the future.

- The Coordinator's SCA intern provided three staff days to assist the S.O. Conte National Fish and Wildlife Refuge in removing established infestations of water chestnut in identified areas in the basin (MA).

- The Coordinator's Office assisted the MADFW, the NHFG, and the CTDEP in the transport, delivery and stocking of Atlantic salmon fry from April into May from White River NFH.

- The Coordinator began retrieving long-term temperature loggers from Old Lyme, CT upriver to the Moore Reservoir Dam, NH in the fall of 2010. Loggers were placed in lower portions of selected tributaries as well (Salmon River, Farmington River, Westfield River, and White River). A high concentration of units were deployed up and downstream of Vermont Yankee Nuclear Power Station in Vernon, VT to better evaluate the effects of increased thermal discharges at that facility. Data have been downloaded and units were re-deployed at all locations except the following; White River, Comerford Dam tailwater, Moore Dam tailwater and forebay. A separate report with analyses will be developed by spring 2011. Readings are from the fall of 2009 to the fall of 2010, examples are provided later in the report.

- The Coordinator's Office provided funding (federal aid grant) for the Greenfield Community College smolt estimate study in cooperation with FirstLight Power

Resources Services (FLP) and Holyoke Gas and Electric (HGE). This study was designed to estimate total smolt emigration for the basin upstream of Holyoke. The 2010 estimate was 245,000 smolts (+/- 95% of 135,000).

- The Coordinator's Office completed three grant agreements to financially support: 1) Town of Alstead, NH, Warren Brook Habitat Restoration; 2) Town of Easthampton, NY, Alewife Brook Scoy Pond Habitat Enhancement and Restoration; and 3) Eastern Connecticut Conservation District, Hallville Pond Dam Fishway. Existing/open grants were administered including a grant to (4) USGS Conte Laboratory for Nash Stream (NH) Fish Movement/Genetics Study, (5) NHFG Nash Stream Fish Population Study, (6) Town of Athol, MA, dam removal project, (6) NHDES for Swanzey Dam removal (two grants), (7) Town of Ashford, CT Leadmine Brook Habitat Restoration, (8) Trout Unlimited (NH) Indian Stream Brook Trout Project, and (9) Trout Unlimited (CT) Deep Brook Water Quality Study.

  In December of 2009, the VTDFW grant to replace Umpire Brook Culvert was completed to benefit brook trout (northern basin). In September of 2010, the removal of the Swanzey Dam (Ashuelot River) was nearly completed with stabilization and grade control structures being installed at that time.

- The Coordinator's staff cleaned and slide mounted adult sea-run Atlantic salmon scale samples. The Coordinator worked with Mr. Steve Gephard (CTDEP) in the aging of salmon scales and developing the 2010 run summary data files based on those data. Some results are presented later in this report.

Outreach

- The Coordinator's Office developed a one day a teacher orientation for the Atlantic Salmon Egg Rearing Program (ASERP) in cooperation with Trout Unlimited and the Massachusetts Division of Fish and Wildlife (MADFW) – January 2010. The ASERP was conducted in 43 elementary schools in western Massachusetts in 2010.

- The Coordinator's Office updated the station website on the Internet (http://www.fws.gov/r5crc) with current information and activities.

- The Coordinator's Office continues to maintain databases on migratory fish restoration activities. Daily fish counts at eight different dams were entered into a database by Office staff. These fish counts were updated daily (M-F during the spring run) on a telephone hotline (413/548-9628) and on the Internet (www.fws.gov/r5crc);

- The Coordinator spoke to five UMASS Natural Resources Program classes in March. A talk on diadromous fish restoration was given to the UMASS Wildlife Society Club.

- The Coordinator gave a presentation, "Connecticut River American Shad History, Management, and Status" at the American Fisheries Society Annual Meeting, Pittsburgh, PA in September 2010.

- The Coordinator provided a written and published response to a series of critical opinion pieces published in two local area newspapers on shad restoration, the salmon program, and the school program with Trout Unlimited. The response provided a comprehensive response to these opinion pieces.

- The Coordinator gave a migratory fish restoration presentation to first and second graders from the Gill Elementary School at the Turners Falls Fishway in May.

Information Management

- The Connecticut River Coordinator's Office maintained a basin-wide program database: all Atlantic salmon stocking events, anadromous fish counts at eight dams, and Atlantic salmon returns. A new fish transfer database to better manage American shad and blueback herring transfers was also updated. These data have been provided to program cooperators through a variety of media.

Program Results

The Connecticut River Coordinator's Office collected and reported information relating to the activities and accomplishments occurring in the Connecticut River basin anadromous fisheries restoration program. The Coordinator's Office compiled and maintained the following program data/information for 2010. [Some of the data presented here is preliminary. For final, accurate, peer reviewed program data/information, refer to the annual U.S. Atlantic Salmon Assessment Committee Report.]

Adult Atlantic Salmon Returns.

A total of 51 sea-run Atlantic salmon adults were documented as returned to the Connecticut River watershed during 2010. This is down from the 75 known returning adults in 2009 (Figure 2). Forty one of these adults were captured at the Holyoke fish lift on the Connecticut River; 4 salmon were captured at the Rainbow Dam fishway on the Farmington River, CT; 4 salmon were captured at the West Springfield Project, MA (formerly the Decorative Specialties International (DSI) dam) on the Westfield River; and one salmon were captured at the Leesville Dam, CT on the Salmon River, another salmon was documented downstream of the Leesville Dam by CTDEP in the summer and was not observed subsequently in the fall. The single control fish released in March 2010 in the lower Westfield River, was recaptured at Holyoke Fish Lift in mid October (2010). While this fish did produce very few fresh eggs, scale reading/analyses indicated it had not left freshwater. It was decided that this fish would not be added as a return and is scheduled for release once again.

From the 41 sea run adults trapped at Holyoke Fish Lift, ten adults were tagged (radio and

PIT) and released (river km 138) to continue their migrations. Salmon released above the Holyoke Dam were surgically fitted with radio tags as part of a TransCanada Northeast Hydro Region fish passage study on the Deerfield River. Two fish were monitored in the Deerfield River (MA), three in the West River (VT), and one in the Cold River (NH). The remaining fish continued upstream of Bellows Falls, one in the Black River (VT), one in the Williams River (VT), and two passing upstream of Wilder Dam. One of the fish passing upstream of Wilder was located in the Ammonoosuc River (NH). Two salmon were poached from the West and Cold rivers (one each). Monitoring was by a hired consultant and VTDFW biologists.

A total of 40 sea runs were retained for broodstock in 2010; all of the sea runs were transported to the Richard Cronin National Salmon Station (RCNSS), Sunderland, MA for spawning in the fall. There were 26 female and 9 male sea-run salmon spawned (September and October 2010). It was noted that spawning of sea-runs has been advanced on a consistent basis in past 6 years.

Age and origin information was derived from scales and physical examination for adipose fin clip of each salmon when available (e.g., fish in Salmon River never captured and some scales not possible to accurately age). Of the 51 salmon documented as returned in 2010, 48 fish were determined/observed to be of wild origin and three were of hatchery origin (smolt stocked). Known sea-age (sea winter = SW) of wild salmon was comprised of one 1SW (grilse) and forty-seven 2SW salmon. Freshwater age (at smolt emigration on readable scales) of wild salmon was comprised of one salmon age 1+, 41 salmon age 2^{+}, and one salmon age 3^{+} fish. All three hatchery origin fish were aged as two-year old stocked smolts and also were 2 SW.

Atlantic Salmon Egg Collection (Fall 2009).
State and Federal fish culture facilities, located within four basin states of Connecticut, New Hampshire, Vermont, and Massachusetts, spawned sea-run, kelt and domestic brood stock and incubated a total of 10.864 million eggs in 2009 and into 2010.

> *Sea-Run Brood Stock:* A total of 317,000 sea-run salmon eggs were taken from 46 females at the RCNSS in October 2009. All fish and eggs tested negative for IPN and other pathogens of concern.
>
> *Captive/Domestic Brood Stock:* A total of 9.905 million eggs were taken from 1,975 domestic females held at the Roger Reed State Fish Hatchery, Kensington State Fish Hatchery, and White River National Fish Hatchery.
>
> *Kelts:* A total of 642,000 million eggs were taken from kelts held at the North Attleboro National Fish Hatchery.

Juvenile Atlantic Salmon Releases.
A total of 6,078,349 Atlantic salmon were stocked into the Connecticut River watershed in 2010. This compares with 6.5 million salmon stocked in 2009. The 2010 total includes

5.198 million unfed fry, 810,910 fed fry, 6,255 age-1 fall parr, 19,036 age-2 parr, and 43,017 age-2 smolts (viable) stocked into tributary systems. Smolts were stocked in the Farmington River (22,173), Deerfield River (19,840) and Westfield River (679).

Study smolts were released as part of a fish passage study at Moore Dam (757 smolts all VIE tagged). From this study 111 viable smolts were released below McIndoes Dam when it was determined they could not be used. Study smolts were also released at Woronoco Dam-Westfield River (135 smolts). Both studies were conducted by Normandeau Associates. Study smolts were graded for size (>150mm) without regard to fatal fin condition. Fatal fin condition adjustments were not applied to the handled study fish with the exception of the lot released below McIndoes, which were not tagged, but were released very late, mid June.

Two year old smolts were assessed to determine the proportion of parr vs. smolt (length threshold), fatal fin condition, and viable smolt beginning in 2006, by CTDEP staff working with federal hatchery managers and agency partners. Data from assessments at Dwight D. Eisenhower NFH (formerly Pittsford Hatchery) and Berkshire NFH in February 2010 was used to provide finer scale data on stocked viable smolts (minus proportion with fatal fin condition) and parr (fish <150mm). A summary report for the ongoing Smolt Assessment Program was prepared and distributed in June 2010 by CTDEP. As in the past, hundreds of volunteers donated hundreds of hours of their time to stock fry throughout the basin.

Juvenile Atlantic Salmon Population Status.

FirstLight Power Resources, HGE and the Connecticut River Coordinator's Office contracted with Greenfield Community College (GCC) to conduct a mark-recapture smolt population estimate in 2010. This was the 18th consecutive year that an estimate study has been conducted by marking smolts at the Cabot Station bypass facility and recapturing them at the bypass facility in the Holyoke Canal. The 2010 estimate was 245,000 +/- 135,000 (95% confidence) smolts from the upper basin. At the lower 95% confidence level, an estimate of 110,000 smolts is one of the highest in the time series. This was not unexpected as wetter than normal summers and index site assessments in preceding years had indicated very good survival of stocked juveniles. This study is planned for implementation again in 2011.

Juvenile salmon populations were assessed by electrofishing in late summer and fall of 2010 at index stations throughout the watershed. Sampling was conducted by CTDEP, MADFW, NHFG, VTFW, and USFS. Data are used to evaluate fry stocking, estimate survival rates, and estimate smolt production. Index site assessment data is incomplete at the time of this report. It was noted by agency staff that juvenile salmon densities/survival were variable, ranging from poor to good at sites for 2010, partially attributed to a generally dry summer season, particularly in the lower basin. It was noted upper basin maintained better stream flows from what was reported as more consistent rainfall events. Data from the summer and fall of 2009 are reported in the U. S. Atlantic Salmon Assessment Committee Report (2010).

Genetics.

Sea-Run Broodstock Management

The USFWS analyzed genetic diversity of the sea-run Atlantic salmon broodstock using

microsatellite analysis as part of an established management protocol. As in the past, all of the sea-runs were PIT-tagged to ensure individual identification at spawning (fall of 2009) and for this report narrative September 2010. In 2009 all sea-run fish at RCNSS were implanted on October 2, 2009 with the first spawning on October 7, 2009 second spawning on October 13, 2009 and partials spawned on October 16, 2009. A total of 67 family jars were created using sea-run and kelts (ten females) in 2009, to meet the target minimum 50 family groups. One female was accidently used twice, resulting in a total of 66 families for future broodstock production, with some observed poor survival among the kelt family eggs. After fish health testing of ovarian fluid, sacrificed male sea runs, utilized male parr, and advanced fry, with all tests coming back negative (clean), eyed eggs were shipped to White River NFH for continued incubation.

Transfers of kelts from RCNSS in December 2009 to North Attleboro NFH (NANFH), resulted in high mortality rates, not previously observed. In all, 18 of 44 (2009) kelts died. Subsequent fish health testing by USFWS Lamar Fish Health Unit did not identify any pathogens. Later in January 2010, the USFWS notified the CRASC partners that NANFH will no longer be maintaining any more than the two most current year classes of kelts, for 2010 only 2008 and 2009 year classes, from this point forward.

In September 2010 at RCNSS, spawning was managed utilizing hormones after the first natural spawning event on September 28, 2010, implants occurred on October 1. It was decided by the Fish Culture Subcommittee to not hormone implant until after the first natural spawning date in 2010. As a result, the first egg take was relatively low on September 28, 2010, after which the remaining fish were hormone implanted. This approach was driven by a concern of having adequately mature/running male parr to achieve mating diversity/spawning goals (one female has her eggs split among three different males – draft Broodstock Plan). In addition, it was decided to implant a portion of the parr with the hormones. Dr. Steve McCormick (USGS) headed that activity/evaluation. Hormone implanted parr produced good quantities of milt at the desired timing. Milt evaluation indicated viable sperm. Evaluations on egg eye-up is underway for eggs utilizing hormone treated parr vs. other sources of milt (sea-run males and control parr).

A mating protocol to maximize the genetic variation of the sea-run mating pool for future generations was again used supported by a genetic software program managed by USFWS Lamar Genetics Group. The genotyping of sea-runs may also be used to identify the families for future analysis.

Genetic Monitoring

The genetic monitoring study was initiated thirteen years ago with the objective of evaluating the relative productivity of habitat throughout the basin based on survival of genotyped salmon smolts stocked as fry in known locations as well as stream origins of returned (marked) adults. The results of this study could help managers make better decisions about stocking strategies, habitat restoration needs, fish passage priorities, and etc. at a landscape level. Marked fry were first stocked in 2002 and the design utilizes a partitioning of the basin into ten zones of management interest, principally from North to South. The number of

marked fry stocked in the basin has ranged from 1.4 to 3.6 million (as a proportion of the total fry stocked annually it varies) annually since the projects implementation.

Samples of smolt (tissue) were taken at the Rainbow Dam bypass, Cabot Station and Holyoke Dam bypass. These tissues have been archived at the USGS Conte Lab in Turners Falls, and with the use of VTFW State Wildlife Grant (SWG) funds (developed by Jay McMenemy), the USFWS Fisheries Program funding, USFWS Lamar Genetics Group, and NOAA Fisheries, this program is on track to analyze current year samples and then address back logged samples. FirstLight Power, Holyoke Gas and Electric and CTDEP have agreed to allow use of the costs of their smolt related operations to meet required non-federal "in-kind" match for SWG projects. It was also decided by the Commissioners at the January 2010 CRASC meeting that this genetic marking program will conclude with the stocking of the last group of known genotyped (family group) fry in the spring of 2011. The last group of marked smolts (as age-2) are expected to be sampled in 2013 at smolt sampler facilities, with adult returns of these marked fish principally in 2015 (stated grant conclusion), which has been determined to be final year of examining adults for marks.

Fish Passage & Habitat Restoration.
The USFWS' Hydropower Coordinator, John Warner, is the lead for most of the activities summarized below and works closely with State Agency representative.

Holyoke Project – Modeling and design of new screening and a bypass for the Hadley Falls Station continue. HGE has withdrawn plans for a new turbine at the Bascule gate.

Turners Falls Project – The modified Gatehouse entrances were tested again 2010 using radio tagged American shad. To improve entry, design modifications were installed by FirstLight Power Resources Services (FLP). A fairly substantial change relative to fish performance (passage efficiency) was observed based on the ongoing telemetry study by USGS Conte Lab. At the time of this report study findings were not available. Planning for construction of a fish elevator to replace the Cabot Station ladder was advanced in spring of 2010. The state and federal agencies and power company agreed to proceed with development and review of plan drawings, with a review of said plans in October 2010. Unlike recent past years, the canal outage did not occur in 2010 due to the extensive nature of the maintenance work completed in 2009.

Entergy Vermont Yankee Nuclear Power Plant – Tritium leaks into the plant's ground water was detected at monitoring wells in January 2010. The source of leaks and remediation measures did not occur until March of 2010. The Coordinator submitted a letter to the Chair of the Nuclear Regulatory Commission regarding unknown impacts to biological resources, monitoring efforts, and actions and concerns. A response was received that in summary stated these leaks are not uncommon and they (NRC) had no environmental concerns. No tritium was detected by any of the utilized testing approaches in the river proper. A vote by the Vermont State Legislature in January 2010, as currently stands, will not permit continued operation of the plant past its approved license period, ending March 2012. It is unclear

whether this vote will stand or what other options may be exercised on behalf of the plant owners and the NRC.

The Atlantic salmon smolt studies as outlined by Entergy in four phases were again not initiated in 2010. Entergy's position is that they cannot accurately determine the effects (i.e., distance/duration) of the plants thermal plume downstream without having details on Northfield Mountain Pump Storage Facility (NMPS) operations. NMPS has declined providing operation details for proprietary purposes and the FERC has ruled in their favor. As a result, the subsequent phases for the smolt studies have been on hold due to the position by Entergy that absence these data, studies to examine smolt behavior or laboratory studies cannot be properly designed. The agencies have responded that alternative measures to model the thermal plume can and should be explored. The start of relicensing process for NMPS in 2012 (license expires 2018) will result in the availability of operation schedule.

Agency staff met with Entergy and its consultant in May 2010 and officials to discuss historic data, methodologies, analytical approaches, and future data needs for fish population assessments. A new control area was recommended, upstream of Bellow Falls Dam. Annual reports were provided and reviewed. An agency response for the need to address items was developed and submitted via the agencies Chair – Ken Cox of VTFW. The Coordinator will utilize temperature logger data from the previously mentioned study to better describe changes in water temperature as observed in 2009-2010 in relation to VY plant operations. Figure 3 shows the temperature profiles taken from two of the mentioned data loggers upstream and downstream of Vermont Yankee for mid May through mid July 2010 as an example of these data.

Fifteen Miles Fall Project – A downstream smolts study was again conducted in 2010. Study results have not yet been provided. Flow inducers were installed to improve flow field. Evaluation is scheduled to continue in 2011. Smolts captured at Moore are trucked downstream and released below McIndoes Project.

Gilman Dam – Still working with owner on revised downstream fish passage design. Modifications to their screening plan are in the works with construction planned in 2011.

No. 3 and No. 4 Projects – (Deerfield River) – the No. 3 intake screen under construction.

Fiske Mill Project (Ashuelot River) – Construction of fish lift is underway target date for operation is spring 2011.

Homestead Woolen Mill Dam, Swanzey (Ashuelot River) – Dam removal was initiated in the summer of 2010. The dam was removed and stabilization and grade control structures were being installed at the end of September (2010).

Collinsville Upper and Lower Dams (Farmington River) – Also known as Canton Hydro, preliminary permit issued, no recent consultation on fish passage.

Manhan River Dam, (Manhan River) – The Town of Easthampton was awarded an ARRA USFWS Grant to construct a 4 foot denil fishway which was begun in 2010. Design and site issues have developed that require substantial additional funding in order to complete construction (several hundred thousand more dollars). Work is on hold pending needed additional funds. Melissa Grader (USFWS) is lead for this project.

New Hydro Proposals at Corps Dams (West, Black, and Westfield rivers) – Ball Mountain and Townshend are still actively being pursued. Major issue is downstream passage and entrainment. Very small, high speed units are being proposed with assumed 100% smolt mortality. No agreement on passage facilities. ACOE does not support development of hydropower at these (their) facilities.

Northfield Mountain Pump Storage FirstLight Power (FLP) – The Coordinator was contacted week of July 19th regarding sediment plumes from NMPS facility as part of their scheduled maintenance plan, which was to be completed by late spring. The Coordinator visited the river reach and contacted MADEP (Catherine Skiba) voicing concerns, "they were aware, reviewing situation, with EPA." Coordinator contacted FirstLight, obtained response and turbidity monitoring data. Coordinator also contacted FERC (DC Compliance Head) and MADFW. EPA issues cease and desist order for silt pumping (August 3rd), agencies (MADEP and EPA) work to develop a plan of action with FLP – early August. FLP estimated 36,000 – 45,000 cubic yards of sediment pumped into river, determined to largely deposit from tailrace to ~ 800ft downriver. In September agencies and FLP had a plan and silt was removed from river (pre-release level target). The plant was expected to resume operation in November 2010.

Migratory Fish Returns.

American Shad - A total of 168,794 adult American shad were counted in 2010 at all passage facilities in the basin. This compares with 162,067 shad last year. A total of 164,439 shad were passed upstream of the fish lift in Holyoke, Massachusetts in 2010 (Figure 2). A total of 3,449 shad were passed upstream of the West Springfield Project in 2010 (previously referred to as DSI), which is a substantial increase from 1,381 passed in 2009. A total of 560 shad were passed upstream of the Rainbow Dam Fishway on the Farmington River in Connecticut, up from the 37 fish passed in 2009. Of the shad passed above the Holyoke Dam, 16,768 shad were counted passed at the Gatehouse in Turners Falls which is a substantial improvement from 2009 (total of 3,813 passed). This is only 10.2% of the number passed at Holyoke (Figure 4). Continued operational and structural changes at the fishway entrances, and environmental conditions are all believed to have contributed to the increase in passage 2010. The continuing drop in shad that passed upstream of Vernon Dam is of great management concern (Figure 4). The Vernon Fishway counted 290 shad passing upstream despite the relatively large number passed at Gatehouse (1.8% the number of shad passed at Gatehouse Ladder/Turners Falls). Shad were again transported upstream and out of

basin for restoration efforts as reported earlier in detail.

Blueback Herring - A total of 92 blueback herring were counted at fishways in the Connecticut River basin in 2010, up from 39 counted in 2009, most (76) passed upstream at the Holyoke Dam fishlift. These numbers reflect the near complete loss of herring that had been passing at Holyoke in past years but is not believed to reliably serve as a population metric for the lower river, and larger lower tributaries, in suitable habitat downstream of fishways (Figure 2). This is a viewed as critical assessment need which was addressed by the Coordinator's Office in 2010 by population assessment work as well as a new restoration strategy (described earlier). This work will continue in 2011.

Sea Lamprey - A total of 44,431 sea lamprey were observed returning to the Connecticut River basin in 2010 based on fishway observations. This compares with 21,402 lampreys in 2009. A total of 3,100 sea lampreys were passed upstream of Rainbow Dam, 485 lampreys were passed upstream of the West Springfield Project, and 39,782 lampreys were passed upstream of the Holyoke Dam (Figure 2). A total 3,179 sea lamprey passed upstream of Vernon Dam, and 392 sea lamprey passed upstream of Bellows Falls Dam.

Striped Bass - A total of 298 striped bass were counted at the Holyoke Dam Fish Lift in 2010 consistent with recent years' observations.

Gizzard Shad - A total of 76 gizzard shad were counted at the Holyoke Dam Fish Lift in 2010.

American eel – A total of 5,398 American eel were counted at fishways and eel passes as moving upstream in 2010 as compared to 5,754 in 2009 (same facilities). The 2010 summary consists of; Holyoke Dam (4,138), West Springfield Dam-Westfield River (371), and Rainbow Dam-Farmington River (889).

FIGURES.

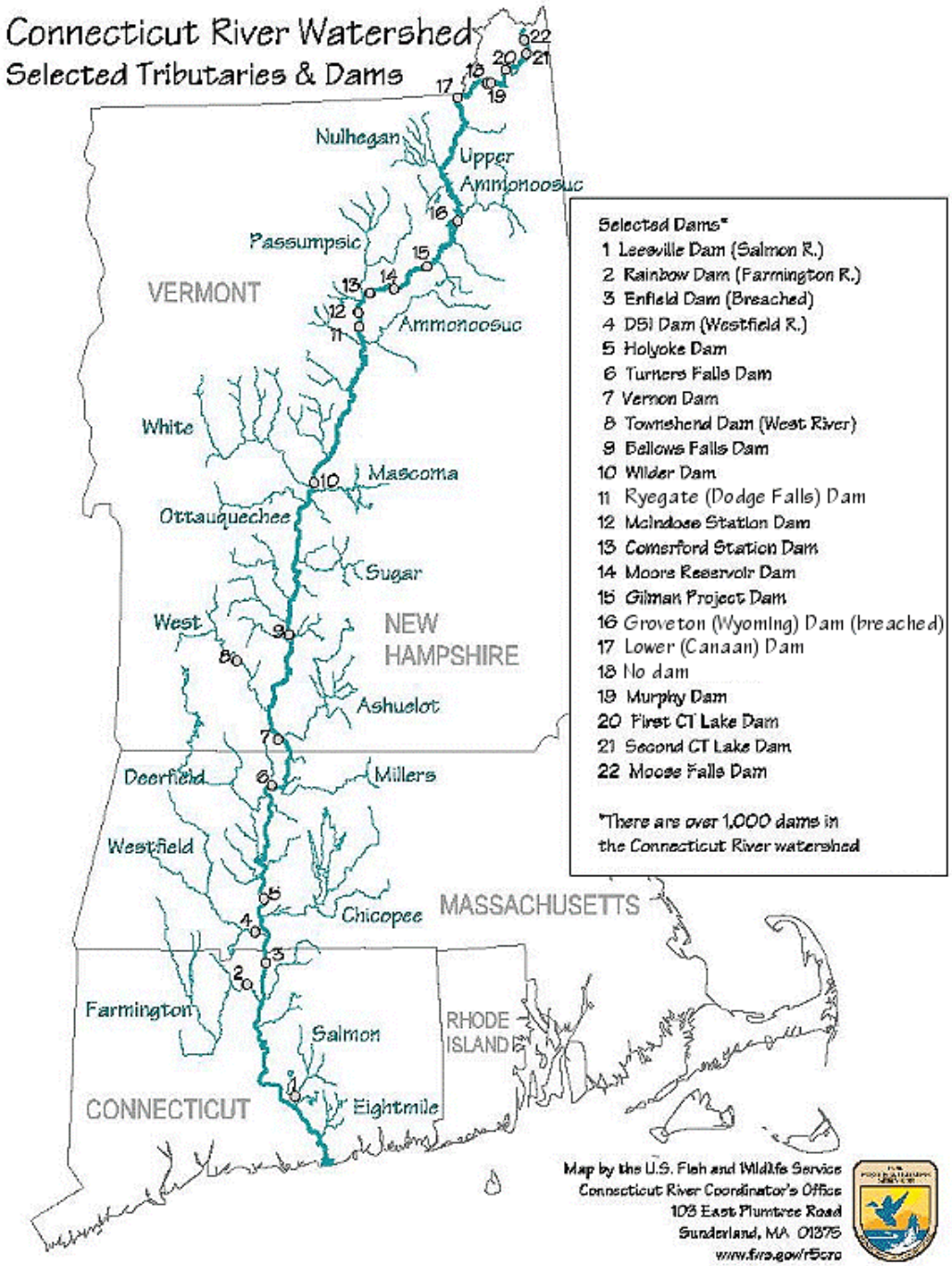

Figure 1. Connecticut River basin with major tributaries and major mainstem dams shown.

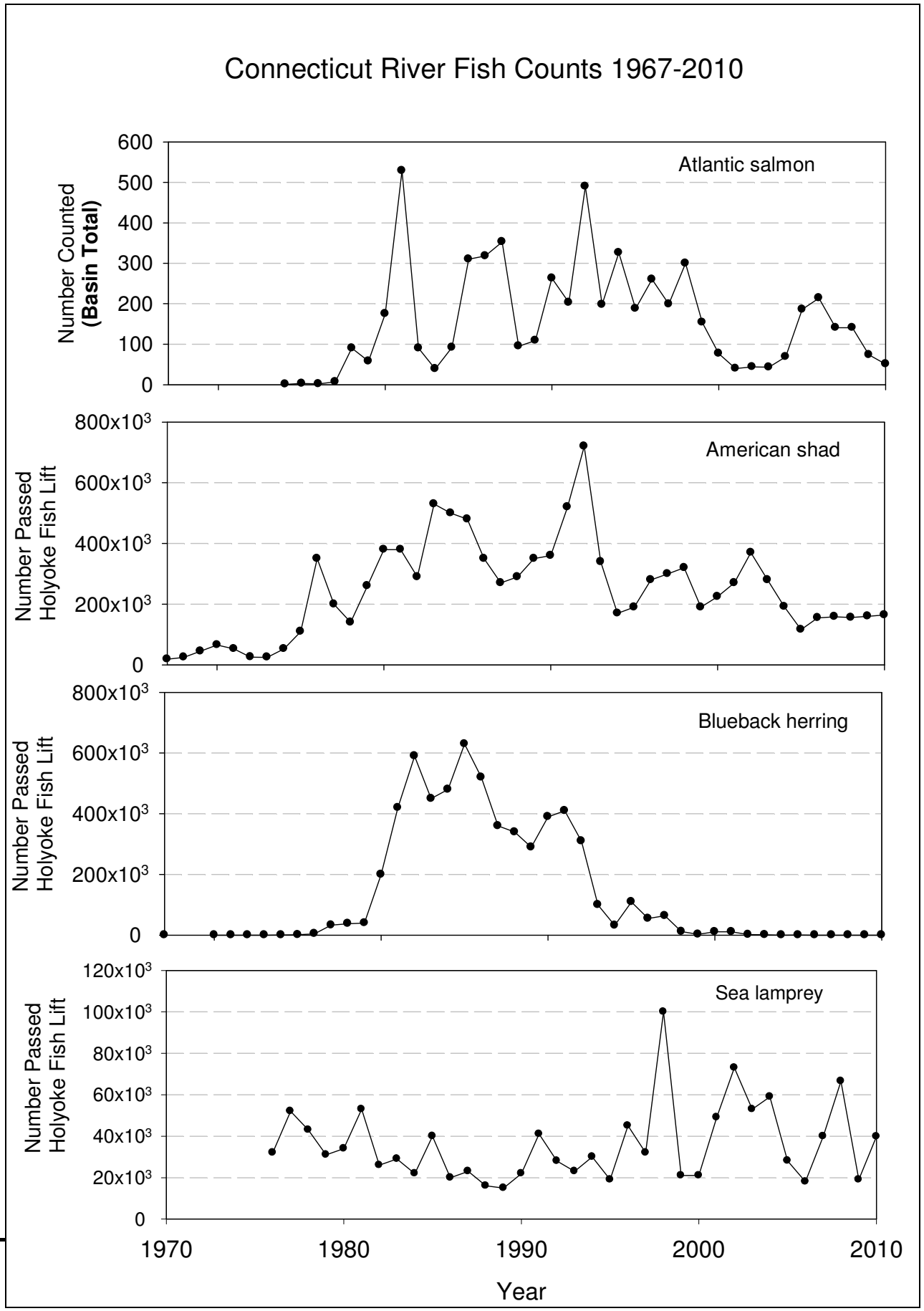
Connecticut River Fish Counts 1967-2010
Atlantic salmon
Number Counted
(Basin Total)
600
500
400
300
200
100
0
American shad
Number Passed
Holyoke Fish Lift
800x10³
600x10³
400x10³
200x10³
0
Blueback herring
Number Passed
Holyoke Fish Lift
800x10³
600x10³
400x10³
200x10³
0
Sea lamprey
Number Passed
Holyoke Fish Lift
120x10³
100x10³
80x10³
60x10³
40x10³
20x10³
0
1970
1980
1990
2000
2010
Year

Figure 2. Summary of Atlantic salmon returns to Connecticut River basin, and Holyoke Fish Lift passage counts for American shad, blueback herring and sea lamprey (1967-2010).

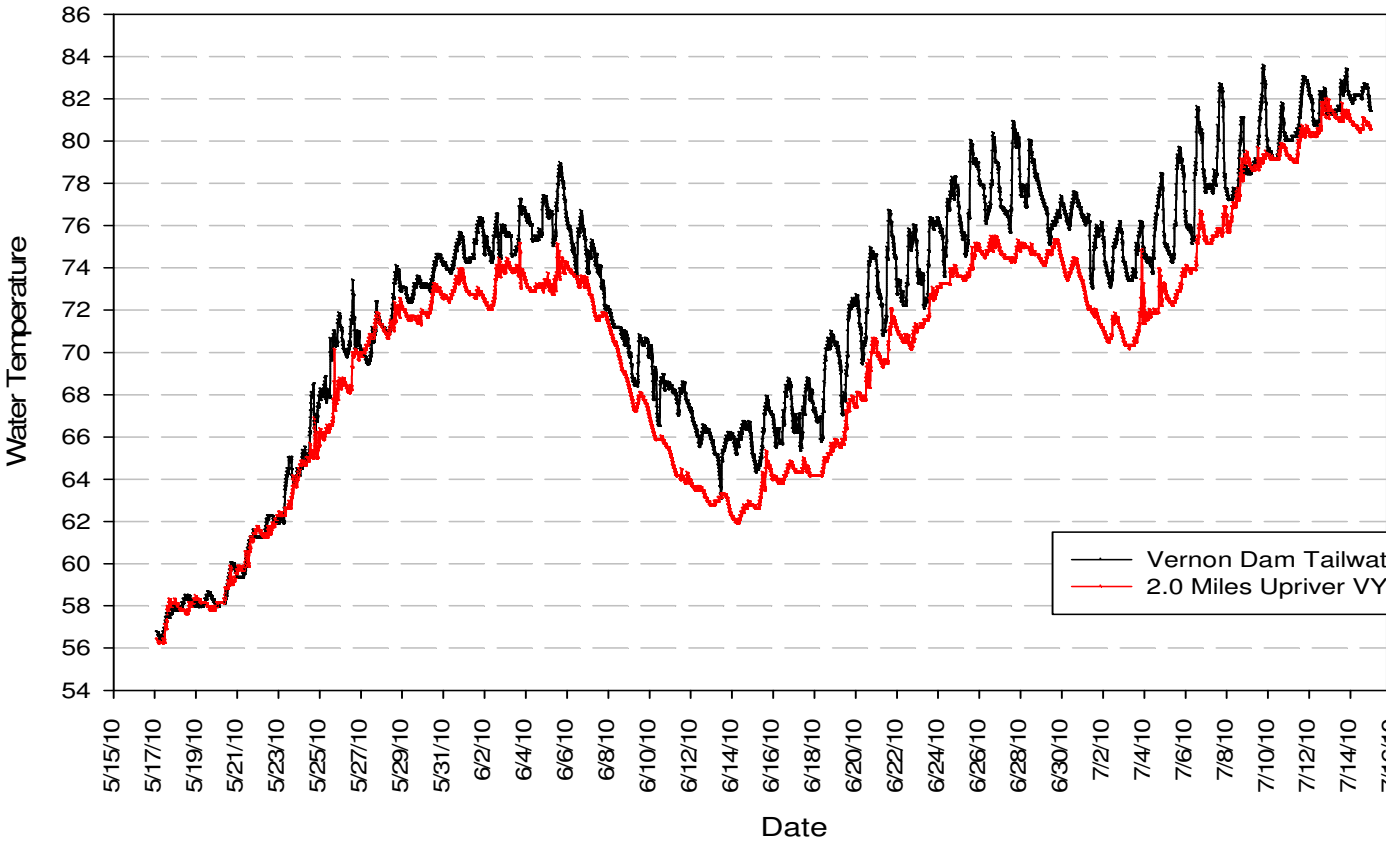

Figure 3. Water temperature profiles taken from data loggers located approximately 2.0 m
upstream of Vermont Yankee station and the tailrace of Vernon Dam for the period of Ma
2010 through July 15, 2010. The VY station was offline in early spring, coming back onlin
discharging heated effluent on a consistent, full discharge basis, beginning on May, 26 fo
some variable discharges beginning on May 21, 2010.

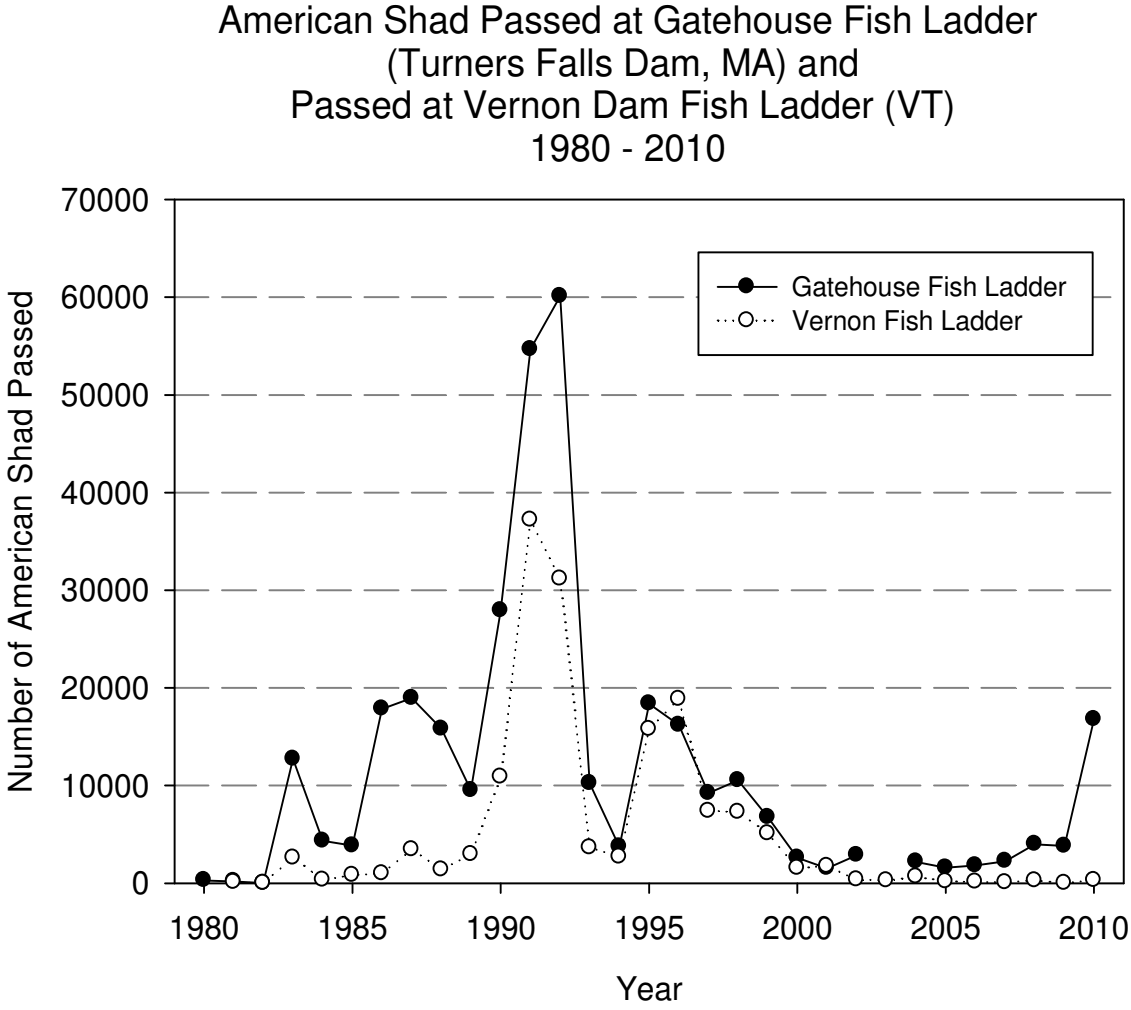

Figure 4. American shad counted as passing the Gatehouse Fish Ladder at Turners Falls Dam 1980-2010 and the number counted as passing Vernon Dam Fish Ladder 1981-2010. Dam and fishway operational, structural, and environmental parameters have varied and been modified over this time period.

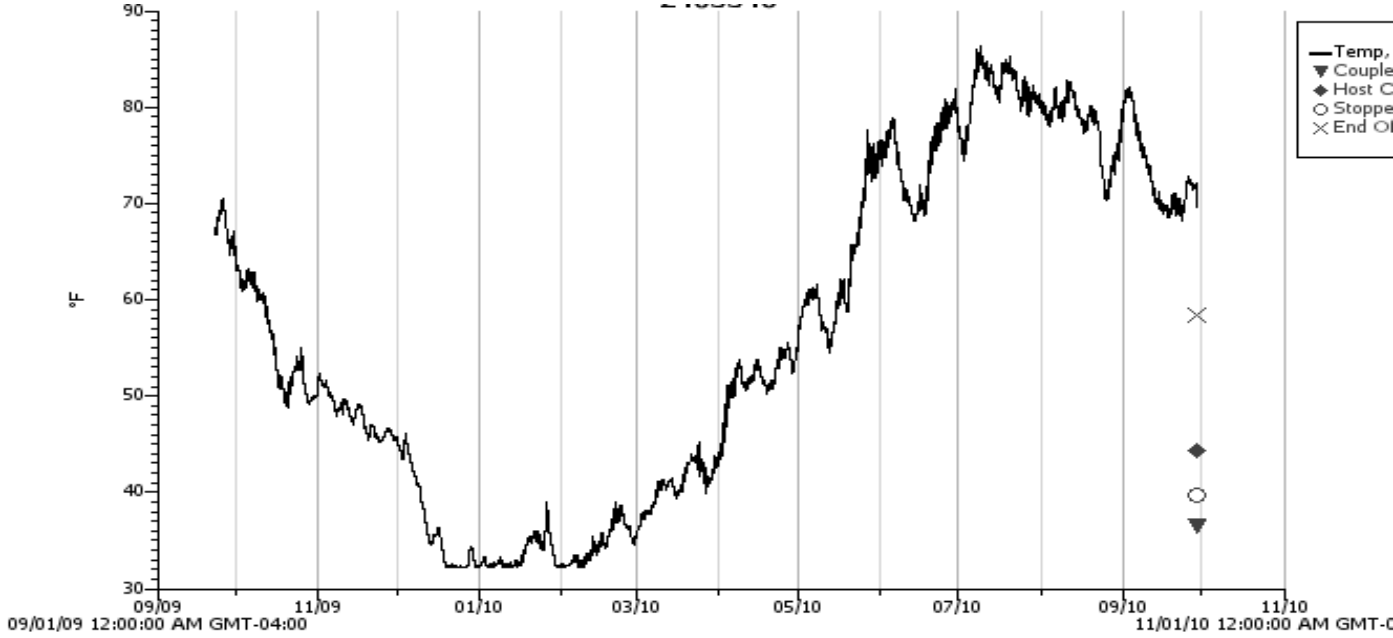

Figure 5. Water temperature profile from temperature logger deployed in Rocky Hill, CT mainstem river (September 2009 through October 2010) – USFWS CRC study.

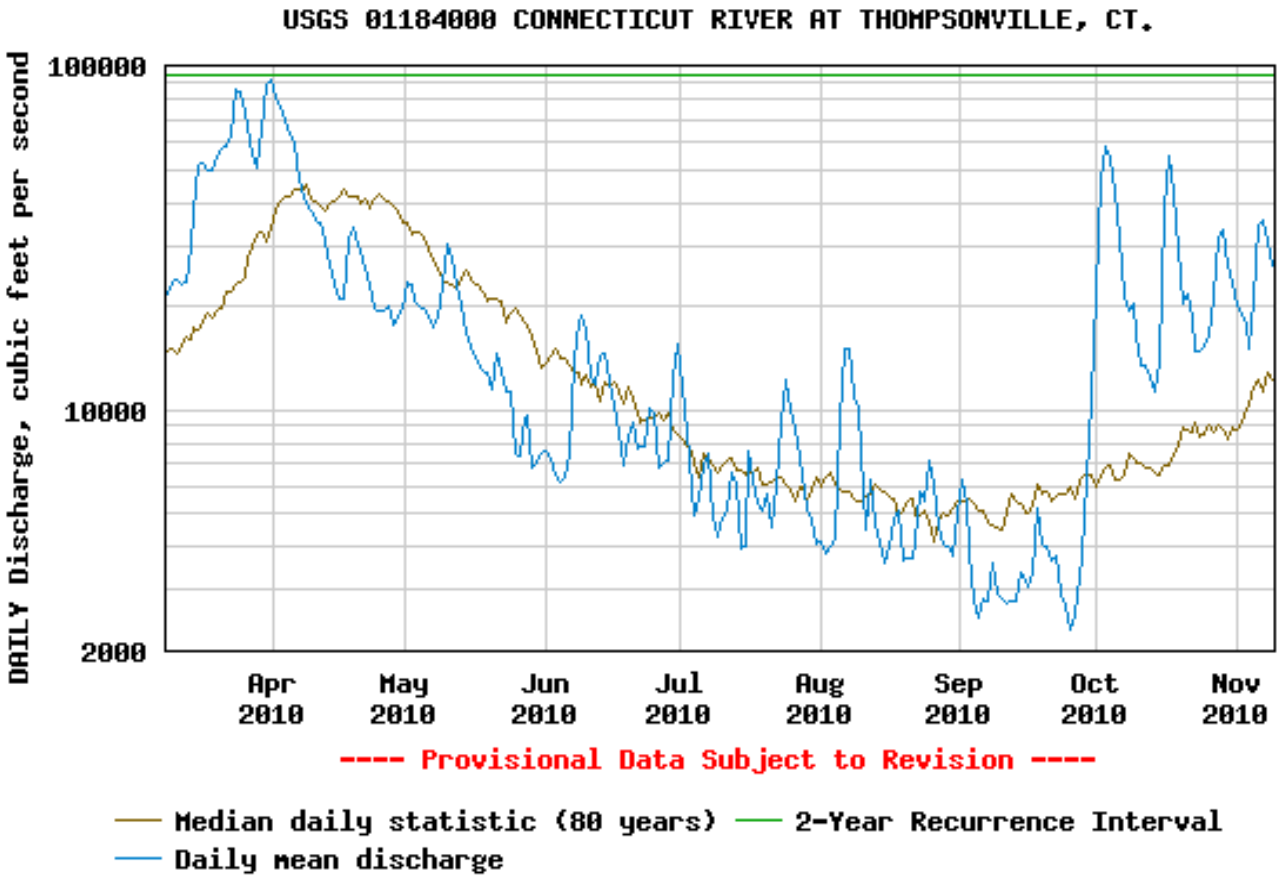

Figure 6. River discharge history for 2010 fish passage season, Thompsonville (CT) USGS Gauge Station. The spring season had consistently low flows and the summer was generally low flow with periodic pulses of higher flows. These spring conditions influenced fish passage rates and facility operations as well as increased rate of water temperature increases when above average temperatures were experienced on a number of dates.

Appendix A. Description of the Connecticut River Basin

The Connecticut River is the longest river in New England. It begins in the Fourth Connecticut Lake (2,625 feet above sea level), and collects water from several major tributaries as it flows South between the states of New Hampshire and Vermont, and through Massachusetts and Connecticut. After collecting water from the 11,250 square mile drainage basin, the river flows into Long Island Sound at Old Saybrook, Connecticut, over 400 miles from its origin.

The river basin environment varies from highly developed and urbanized stretches in the lower river valley to more rural and forested reaches in the tributary and headwater areas. Atlantic salmon habitat exists throughout the basin. There are 38 major tributaries of significance to the Connecticut River Atlantic Salmon Restoration Program.

The natural streambed gradient profiles are interrupted by artificially ponded stretches created by the numerous dams located on the river and its tributaries. Over 1,500 dams in the basin impact and fragment habitat and natural steam processes (Figure 1). Hydropower dams can additionally regulate/alter flows, particularly in the mainstem and lower reaches of larger tributaries. Summer water temperatures average between 70^{o} and 80^{o}F with temperature peaks sometimes reaching 90^{o}F in July and August. Figure 5 provides data for Rocky Hill, CT reach for fall 2009 through fall 2010. Figure 6 provides river discharge as measured at the USGS gauging station, Thompsonville, CT for the period April through November 2010. Tributaries generally have cooler water temperatures and, as such, provide better habitat for juvenile salmon. Water quality throughout the basin supports all freshwater life stages of salmon. However, degraded reaches exist, particularly in the mainstem river in Connecticut and Massachusetts, where 84% of the basin's 2.3 million people reside.

The Connecticut River and its tributaries support a diverse group of fishes and invertebrates. Both intentional and accidental introductions have altered native fish communities within the basin. Currently, at least fourteen species of migratory fish inhabit the Connecticut River, including Atlantic salmon, American shad, alewife, blueback herring and shortnose sturgeon.

Appendix B. Atlantic Salmon Life Cycle

Atlantic salmon spawn in October and November, females construct redds, burying their eggs following fertilization by a male(s). Fertilization may occur by a single or multiple adult sea-run males and/or single or multiple mature male parr. Most females lay a total of 7,000 to 8,000 eggs in two or more redds. A steady supply of clean, well oxygenated water is critical to sustain these eggs. The eggs remain in the gravel throughout the winter before hatching in the spring. Newly hatched salmon, called sac fry, obtain food from their attached yolk sac. The salmon emerge from the redd, primarily from April to June, when the yolk sac has been completely absorbed and begin to disperse into habitat. Feeding activities begin at this time so timing of emergence with food item availability is of importance. Salmon fry, approximately one and one quarter inches long at emergence, quickly set up feeding territories which they defend from other fish.

Fry that have spent their first summer in the stream where they hatched are three to four inches long by fall and are called parr. After one full year in freshwater, the parr will have grown to a length of four to six inches. Parr remain in freshwater for a period of one to three years. The freshwater residence period is largely dependent on growth rate. The fastest growing parr, usually from warmer, more productive tributaries, spend only one year in freshwater. Slower growing parr, often from colder, less fertile tributaries, spend three, or rarely, four years in freshwater. Most parr in the Connecticut River basin spend two years in freshwater. During their first fall, parr may disperse widely from their first summer location to seek new habitat.

Parr destined to leave the freshwater environment the following spring begin a process called smoltification during the preceding winter. Pronounced physical changes occur during the spring after salmon reach a size suitable for migration to the sea, six to eight inches or more. These changes allow juvenile salmon to adapt to life in marine waters. Throughout the smoltification process a series of behavioral, physiological, and morphological changes occur that transform young salmon from territorial, bottom-dwelling, freshwater fish to schooling, saltwater fish. Juvenile salmon leaving for the ocean are called smolts. Smolts lose the dark vertical stripes, parr marks, on their sides and become bright silver in color. Smolts migrate to Long Island Sound from April through June. Some smolts may commence pre-smolt movement in the fall to start their long migration. This is believed to have been an important adaptation of the original upriver stocks of Connecticut River salmon.

Connecticut River smolts move eastward around Cape Cod and begin a long migration northward along the coast after reaching Long Island Sound. The salmon reach waters off of the west coast of Greenland in late summer where they share feeding grounds with other Atlantic salmon from North America and Europe. Most Connecticut River salmon return to spawn after residing in the ocean through two winters (2SW). A few salmon, called grilse, return after spending only one winter at sea (1SW), and others wait until after their third sea winter to return (3SW). The average 2SW salmon grows from six inches long and weighing about two ounces as a smolt entering Long Island Sound to 30 inches and 10 pounds as a

returning mature salmon. Grilse (1SW) average about four pounds and 3SW salmon often weigh more than 15 pounds.

Adult salmon return to the Connecticut River primarily in May and June. These salmon attempt to reach the streams where they resided prior to emigrating as smolts. They spend the summer holding in deep pools before spawning in the fall. From the time they enter their natal river until spawning, often six months later, the salmon do not feed; feeding begins after they return to saltwater in the fall or spring. Atlantic salmon, unlike Pacific salmon, do not die after spawning, though many die as a consequence of the rigors of the upriver migration, the spawning effort itself, and not feeding for up to one year while in freshwater. Adults that survive the rigors of migration and spawning change from silver to a very dark color and are called kelts. Kelts return to the ocean in late fall or early spring, at which time they regain their silver color. A small percentage of salmon survive several spawning runs alternating between freshwater and marine environments. Repeat spawners and grilse are valuable to the salmon population for maintaining genetic variability and providing a buffer against poor smolt outmigration years. Additionally, repeat spawners are particularly valuable to anglers because of their large size.

Appendix C. History of the Anadromous Fish Program

Atlantic salmon were once abundant in the Connecticut River and spawned in all major tributaries not blocked by natural barriers. Salmon ascended the mainstem Connecticut River to Beechers Falls, VT, nearly 400 miles upriver from its outlet at Long Island Sound. No fishery management or scientific information exists that provides a technical description of the pre-colonial salmon population because extirpation predated the development of fishery science. However, historical accounts of the region are filled with references to large salmon runs and significant use of the species by the native aborigines and early European settlers. As colonization by Europeans and the development of water power sites expanded throughout the basin, the salmon population declined. The major cause of the decline was the construction of dams that block salmon migration to upstream spawning habitat (Figure 1). The first dam across the mainstem Connecticut River was constructed in 1798 near the present site of Turners Falls, MA. It blocked the access of salmon to the remaining spawning habitat in the northern portion of the river and the species disappeared from the basin.

An interagency state/federal program to restore salmon to the Connecticut River based on the stocking of fry hatched from eggs taken from Penobscot River salmon was initiated in the 1860s. Although the effort resulted in the return of hundreds of adult salmon for several years in the 1870s and 1880s, the program eventually failed due to both uncontrolled harvest of fish in Connecticut waters and the failure to construct effective fish passage at dams in Massachusetts.

Interest continued in restoring salmon in the basin; however, no action was taken for decades due to the lack of funds and effective fish passage technology. The condition of the river environment continued to deteriorate in response to widespread pollution and dam construction. By the late 1960s, many tributary dams were subsequently washed away and never re-built or were removed and pollution abatement programs were initiated. Long term cooperative restoration programs became feasible with the passage of the federal Anadromous Fish Conservation Act of 1965 (P.L. 89-304) which made funds available for interstate fish restoration programs. The combined effects of all these events set the stage for Atlantic salmon restoration.

The current Atlantic salmon restoration program formally commenced in 1967 when the four basin states, USFWS, and NMFS signed a statement of intent to restore anadromous fishes to the Connecticut River. Early stockings were comprised of two-year old smolts of Canadian origin reared in federal trout hatcheries that had recently been converted to salmon production. The first adult salmon return from these smolt releases was documented in 1974.

Between 1974 and 1977, ten more salmon returned from the ocean. Penobscot River salmon eggs became available to the program and were used to stock the river starting in 1976. As a result of this release, 90 adult salmon returned to the river in 1978. Since then, salmon have returned to the river annually, usually numbering in the hundreds.

Early in the program, the emphasis was placed on stocking smolts. The USFS joined the

effort in 1979 because of the impact of the agency's land-based holdings on salmon habitat in the northern watershed. Shortly thereafter, the USFWS built a large, modern salmon hatchery in Bethel, VT, and Connecticut Department of Environmental Protection (CTDEP) and MAFW converted trout hatcheries for salmon production. In 1983 smolt production shifted from a two-year to a one-year rearing regime in an effort to increase the quantity and quality of smolts. Early experimental stockings of salmon fry into nursery habitat showed the potential for natural, instream rearing of natural, high-quality smolts (referred to as "stream-reared" smolts) which are comparable to wild smolts. Evidence from the Farmington River indicated that stream-reared smolts produced from fry stocking yielded substantially greater adult return rates than hatchery-reared smolts. Production of stream-reared smolts was combined with smolts produced in hatcheries to increase smolt emigration from the river. A major effort was begun in 1987 to stock as many fry as were available into appropriate habitat in the basin. Adults produced from fry stocking will attempt to return to spawn to the tributary in which they were stocked. Although numbers of fry stocked to date have been inadequate to fully seed the habitat, stream-reared smolts produced from those releases have contributed substantially to adult returns.

Since 1994, the Program has not imported any genetic material (gametes or fish) and has been utilizing “Connecticut River” fish only. This important fact needs to be taken in the context that a salmon generation is typically 4 years. This translates to four generations occurring from 1994 to 2010. Also importantly, genetic monitoring has demonstrated the development of unique genetic characteristics that distinguish the Connecticut River population from other populations at that scale. The use of conservation genetics has enabled the Program to maintain a genetically healthy population to maximize genetic diversity and reduce risks of inbreeding and outbreeding depression.

Action to provide upstream fish passage on the river had begun prior to the salmon project when, in 1955, a fishlift was constructed at Holyoke to pass American shad and river herring. This facility was expanded in 1975 and 1976 when a trap was built for salmon. Other fishways built between 1974 and 1987 at major dams on the mainstem river and certain tributaries allowed returning salmon access into a large portion of the basin targeted for restoration. Although most salmon are currently retained at the lowermost dams when they reach them, fishways were still constructed at the upstream dams in order to pass American shad and other species, which migrate upstream by the thousands. Fish passage at dams above Vernon Dam (Bellows Falls and Wilder dams) have been built specifically for salmon. An agreement with upstream dam owners stipulated that 10% of all salmon trapped at Holyoke will be released to use these upstream fishways. This number will increase as the run size increases. Four fishways (Holyoke, West Springfield, Rainbow, and Leesville) are the primary trapping locations for brood stock.

Downstream passage facilities, designed to safely guide smolts past hydroelectric sites, were not included in the construction of fishways at the seven originally targeted dams nor were they mandated at other dams in the watershed. This deficiency occurred because of the lack of technology for designing effective site-specific downstream fish passage systems. As the number of fry stocked in the basin increased during the 1980s, concern grew for the

deleterious effect of hydroelectric turbines on outmigrating smolts. Responding to that concern, releases of most hatchery-reared smolts were moved downstream of the lowermost dam. Stream-reared smolts were early on forced to pass through turbines at numerous hydroelectric generating stations as they emigrated downstream to the ocean. Efforts to provide downstream fish passage on both mainstem and tributary projects were initiated in the 1980s. In 1990, memoranda of agreement (MOA) were signed with two major utility companies that operated hydroelectric facilities at six mainstem projects that established time frames for downstream passage construction. Efforts to provide adequate fish passage conditions at these projects and throughout the basin are ongoing. With the installation and evaluation of downstream fish passes, smolts in the mainstem have been stocked upstream of Holyoke Dam, smolts stocked in Westfield River are stocked upstream of the West Springfield Dam, and smolts stocked in the Farmington River are stocked both upstream and downstream of the Rainbow Dam.

Smolt samplers are in place at the Rainbow Dam, Cabot Station (Turners Falls Dam and canal), and Holyoke Dam. A smolt mark and recapture program was conducted for the 18th consecutive year in 2010, with principal funding provided by power companies and also some federal aid dollars from the Coordinator's Office. The study provides a smolt population estimate for fish produced from the upper basin, with an estimated level of precision.

Appendix D. Administrative Report

Total Federal Aid Expenditures – 2010

Heat	$ 1,427.80
Electric	$ 2,144.73
Phone	$ 4,408.18
Vehicle Fuel & Maintenance	$ 1,241.31
Smolt Estimate Study	$ 2,500.00
Office Supplies, Operations & Maintenance	$ 7,141.98
Sub-Total:	$18,864.00
USFWS Overhead:	$ 1,136.00
Grand Total:	$20,000.00

CTDEP (0105)

Electric	$ 725.02
Phone	$ 1,483.71
Office Operations & Maintenance	$ 2,507.27
Total:	$ 4,716.00

VTFW (0113)

Electric	$ 713.67
Phone	$ 1,712.93
Heating/Propane	$ 625.81
Office Operations & Maintenance	$ 1,663.51
Total:	$ 4,716.00

NHFG (0121)

Electric	$ 346.64
Phone	$ 695.62
Heating/Propane	$ 801.99
Vehicle Fuel & Maintenance	$ 591.43
Office Operations & Maintenance	$ 2,280.32
Total:	$ 4,716.00

MDFW (0128)

Electric	$ 359.40
Phone	$ 515.92
Smolt Estimate Study	$ 2,500.00
Vehicle Fuel & Maintenance	$ 649.88
Office Operations & Maintenance	$ 690.80
Total:	$ 4,716.00